ZENO’S METRICAL PARADOX OF EXTENSION AND DESCARTES’ MIND-BODY-PROBLEM

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A philosophical problem may be stated as a conflict between two or more propositions which seem to be prima facie evident, but cannot all be true together. The mind-body-problem as it did arise with Descartes may be formulated with the following three propositions:

(a) Mental phenomena are non-physical phenomena.
(b) Mental phenomena interact with physical ones.
(c) The physical world is causally closed.

These three propositions form together a trilemma, because they all seem prima facie evident, although we cannot accept them all together. Two of them imply the falsehood of a third: If (a) mental phenomena are non-physical phenomena and (b) nevertheless interact with non-physical ones, then (c) the physical world is not causally closed. But if (c) the physical world is causally closed and (a) mental phenomena are non-physical, then (b) interaction between physical and mental phenomena is not possible. But if despite of the (c) causal closure of the physical world we have (b) interaction between physical and non-physical phenomena, then (a) mental phenomena are no longer non-physical.

In the following I use Zeno’s metrical paradox of extension, or Zeno’s Fundamental paradox, as a thought-model for the mind-body-problem. With the help of this the distinction contained in thesis (a) between mental and physical phenomena can be formulated as sharply as possible. I formulate (I.) the above mentioned paradox and give a sketch of four different answers to it. Then (II.) I construe a mind-body-paradox corresponding to the fundamental paradox. Through that it becomes possible (III.) to copy the solutions to the fundamental paradox on the mind-body-paradox. Three of them fail. But (IV.) one of them – the Aristotelian one – gives us an interesting hint. Finally, (V.) this hint should be pursued somewhat further and (VI.) through the comparison with Zeno’s fundamental paradox the impossibility of a solution to the mind-body-problem shall be shown again. The main new point of this article is the comparison of the mind-body-problem with Zeno’s fundamental paradox.

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1 I am following here with small modifications the helpful exposition of P. Bieri, Analytische Philosophie des Geistes, Königstein 1993, 5-7.

2 I am indebted for this idea to lic. phil. I, Kaspar Bächli.
I.

What I call Zeno’s metrical paradox of extension or Zeno’s Fundamental Paradox is the conjunction of two propositions: (a) A point in space or time is indivisible and without extension. (b) A line in space or time is continuous and extended.

Since, however, an extended line in space or time is supposed to consist of infinitely many unextended points in space or time, the two propositions exclude each other: If (a) is true, then (b) is false. If (b) is true, then (a) is false. This paradox is fundamental because it underlies all the other four paradoxes of motion, the Runner, Achilles and the Tortoise, the Arrow and the Stadium (cf. Ferber, 1995, esp. 50-52).

But the two propositions exclude each other only prima facie. In fact, there are at least four answers to this fundamental paradox, which I will outline now in a brief survey (cf. Ferber, 1995, 102-103).

1. Aristotle solves the paradox by his theory of the continuum, whose nucleus may be sketched for our purpose in the following way: If the presupposed set of points is dense, there is a sense in which the predicate “divisible everywhere” applies to quantities and a sense in which it does not. It belongs not to them insofar as the set of points is not divisible everywhere simultaneously. It belongs to them insofar as it is divisible in any point, but not simultaneously. Only simultaneous divisibility in all points leads to the fact that a magnitude may be divided into nothing. Divisibility in any point leads only to a division into small and smaller parts (cf. De gen. et corr. A 2. 317a2-17). When we presuppose the second sense we do not arrive at a paradox. A line does not consist actually of points because points are only potential cuts in the line (cf. Phys. Δ 13. 222a14).

2. The infinitesimal calculus solves the paradox by the method of approaching a limit; the differential calculus insofar as the transition from an extended line to an unextended point is made possible by the postulation of the limit of a line that becomes infinitely small; the integral calculus insofar as a line is described as the sum of an infinite number of infinitely small summands. This sum may be described in turn as a limit that can take the value of a positive number.

3. Cantor’s theory of the continuum solves the paradox insofar as a non-denumerable infinite set of extensionless points may be described as a non-denumerable infinite set of degenerate subintervals. Since a finite interval (a, b) is the union of a continuum of degenerate subintervals, “we cannot meaningfully determine its length in our theory by ‘adding’ the individual zero lengths of the degenerate subintervals” (Grünaun, 1968, 136). We are here confronted with an instance in which “set-theoretic addition (i.e., forming the union of degenerate subintervals) is meaningful”, “while arithmetic addition (of their lengths) is not” (Grünaun, 1968, 136). Cantor’s theory does not assign any meaning to ‘forming the arithmetic sum’, when we are attempting to ‘sum’ a super-denumerable infinity of individual numbers (lengths)” (Grünaun, 1968, 135).